A CAD system for drawing origami diagrams combined with a prediction of folding processes

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Abstract

When we draw a diagram for an origami piece, the cost for drawing every figure for all steps is quite high especially when the target shape is complicated and requires many steps. In this paper, we propose a CAD system which assists users to draw diagrams by presenting predicted figures for the next step (Fig.1).

When we fold an origami, some typical operations are taken such as "placing a point onto one of the other points" and "placing an edge onto one of the other edges". These operations are summarized into 7 axioms which are called Huzita-Hatori axioms. Our system lists up the predicted images for the next folding operation from the current status by using the first 4 of the 7 axioms they are commonly used in popular origami. Before listing up the candidates, the system enumerates all possible crease lines by applying the 4 axioms. Then the duplications of the folded shapes are removed so that the elements in the list become unique. Lastly, the candidates are sorted by their probability. To remove the duplicated shapes, we checked the shape for all possible pairs by rotating and mirroring them. To decide the sort order, we give higher scores to the shapes that creases have popular angles such as 90, 60, 45 and 30 degrees.

With the proposed system, we confirmed that we can design diagrams for some simple origami pieces efficiently. It is also cleared that we have to add more functions to our system for some sort of complicated origami.

By using our prediction function recursively, we could enumerate all possible foldings which starts a single square sheet of paper. According to our implementation, the number of shapes that can be folded with 1, 2, and 3 operations were 2, 13, and 314 respectively.

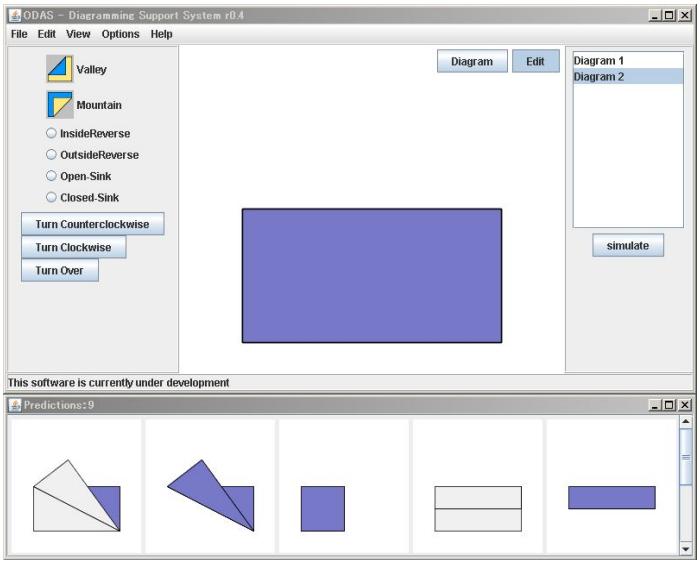

Fig. 1: Our proposed system. The candidates for the next operation are listed in the bottom window.